Effects of high-pass filtering on perception of dialect and talker sex

A Senior Thesis

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TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

ABSTRACT

In speech perception research, researchers have used different types of digital filters to remove parts of speech spectrum and degrade speech. The most common type of filtering is low-pass filtering, where the lower frequency band of acoustic energy is retained and the higher frequency energy is eliminated. The current study uses high-pass filtering, in which the higher band is retained and the lower frequency band is cut off. High-pass filtering preserves high-frequency spectral information and has rarely been used in speech perception research because most speech cues are present in low-frequency region. The study is an extension of Fox et al. (2016), who investigated how much cues about talker dialect and sex were retained in low-pass filtered speech. Using the same stimulus set, the current listeners from Ohio heard phrases produced by males and females from Ohio and from North Carolina that were high-pass filtered at 700, 1175, 1973, 3312, and 5560 Hz. The study sought to establish how much information about talker dialect and talker sex was preserved in each higher frequency band. In an identification task, listeners identified talker dialect and sex. Each higher filter provided increasingly fewer cues about talker dialect whereas identification of talker sex remained relatively high. Female speech provided significantly more dialect cues than male speech when more spectral information was available (filter cut-offs at 1175 and 1973 Hz, but not at 700 Hz). In a separate intelligibility task, listeners typed what they were able to hear. Intelligibility declined to "0" at 3312 Hz. Up to this point, listeners understood speech better when talkers were from Ohio (i.e., in their native dialect) and were females rather than males. These results provide evidence that high-frequency energy in speech spectrum is useful in speech perception. It contributes information about talker characteristics and listeners can utilize these cues in identifying sex and regional dialect of the talker.

Chapter 1

INTRODUCTION

American English spoken in the United States is diversified and pronunciation patterns vary across the country. This variation comes from several sources, including regional dialects, ethnic backgrounds, and foreign-accented productions reflecting demographics of individual states and geographic regions. Recent research in sociophonetics focusing on regional dialect variation has explored various pronunciation patterns by means of acoustic analysis (e.g., Clopper et al., 2005; Fox and Jacewicz, 2009; Labov, Ash, and Boberg, 2006; Thomas, 2011) and perceptual testing (e.g., Clopper and Pisoni, 2004; 2007; Jacewicz and Fox, 2012; 2014). Perceptual experiments provided evidence that listeners build perceptual categories for regional dialects and utilize them to classify speakers and to process linguistic information efficiently.

Specifically, research shows that perceptual representation of dialect variation is shaped by experience with regional features not only in vowels and consonants but also in prosodic (suprasegmental) aspects of speech such as rhythm, intonation, lexical stress, pitch range, speaking rate, and the use of pauses (Clopper and Smiljanic, 2011; 2015; Jacewicz et al., 2010). For example, the New England and Southern dialects have very distinctive temporal patterns that are manifested across several measures, including articulation rate, vowel and consonant variability, and the duration of pauses. Also, Southern speakers have significantly slower speech rate than Northern speakers. These cues are perceptually relevant. This is because growing up in a given dialect region, listeners become familiar with these features as they gain experience with their linguistic environment. Consequently, they process utterances in their own dialect more efficiently than utterances in their non-native dialect, which becomes evident when they travel to another state or another English-speaking country.

The perceptual atunement to dialect characteristics leads to the questions of how these dialect-related cues are distributed over acoustic speech spectrum and which frequency regions contribute most to dialect recognition and classification. Speech perception research used spectral filtering to degrade the speech signal in order to examine intelligibility of speech in selected frequency bands (regions) of acoustic energy, and this method has also been promising in studying the distribution of dialect cues. The most common type of filtering is low-pass filtering, which cuts off spectral content above a given frequency (French and Steinberg, 1947; Pollack, 1948). Low-pass filtered speech retains lower frequency acoustic energy including the tonal quality of the voice. This preserves prosodic aspects of speech such as pitch range, intonation contour, rhythm, speaking rate, and pauses. In general, segmental information should be eliminated with the low-pass filter cut off at 400 Hz. Progressively higher cut-offs permit more graded contributions from segmental sources (i.e., vowels and consonants) so that more semantic information about speech is added with each higher filter.

There are only several studies that used low-pass filtering to investigate the contribution of prosodic cues to dialect identification. Bezooijen and Gooskens (1999) found that prosodic cues within the low 350-Hz frequency band provided very little dialect information for several varieties of Dutch and British English. Frota et al. (2002) found that listeners can make a rhythmic distinction between the two varieties of Portuguese, Brazilian Portuguese and European Portuguese, with filter cut-off at 400 Hz. Van Leyden and van Heuven (2006) showed that prosodic differences between Orkney and Shetland dialects in the United Kingdom were perceptually detectable when intonation and temporal cues were provided within the low 400-Hz frequency region.

More recently, the study by Fox, Jacewicz, and Smith (2016) examined perceptual distinctiveness of two regional varieties of American English using low-pass filtering. In that study, spontaneous speech samples from 20 speakers, males and females, from the Midland dialect in Central Ohio and from the corresponding 20 speakers from the Southern dialect in Western North Carolina were low-pass filtered at 500, 700, 900 and 1100 Hz, which represents a range of progressively higher filters between the low-information cut-off of 400 Hz used in the other studies and unfiltered (or clear) speech. [Note: A filter cut-off of 1200 Hz is viewed as a bridge between lower filters and unfiltered speech (Knoll et al., 2009)]. Listeners were increasingly more sensitive to dialect cues with each higher frequency cut-off, and when listening to male speech rather than to female speech. The male talker advantage was manifested predominantly at the two lowest filter cut-offs of 500 Hz and 700 Hz, whereas sensitivity to dialect cues in female speech was greatest at 900 Hz. Further small improvement was found for males at 1100 Hz, however the unfiltered speech still provided more dialect cues than any filtered condition.

The current study is an extension of Fox et al. (2016) and examines perceptual distinctiveness of the same two dialects using high-pass filtering. In high-pass filtered speech, the higher frequency band is retained and the lower frequency band is cut off, which is the opposite to the low-pass filtering. High-pass filtering has not been used in speech perception research as often as low-pass filtering. There is a historic reason for that, stemming from the early perception experiments such as in Fletcher and Galt (1950) and French and Steinberg (1947). These studies showed that almost all cues to speech intelligibility are contained within the low-frequency region of the speech spectrum, up to 4 kHz, as evidenced by high accuracy of listeners' responses (about 95%). The maximal accuracy was found at 7 kHz, which was

interpreted as indicating that high-frequency energy in speech is unnecessary for intelligible speech. Consequently, research examining the contribution of high-frequency region to speech perception is limited and, to my knowledge, studies exploring the effects of high-pass filtering on dialect classification are non-existent.

Recognizing this gap, there has been a renewed research interest in exploring how listeners may use information in high-frequency region in detecting voice characteristics, particularly those cueing speaker sex. As expressed by Donai and Lass (2015, p. 2453), "Given the scarcity of research in this area, it is important to study all spectral regions of the speech signal that may carry gender identity cues in order to develop a complete understanding of this perceptual process." There is some emerging evidence that listeners can utilize high-frequency energy in the perception of speech and voice. Moore and Tan (2003) found that high frequency region (between 3.5 kHz and 10.9 kHz) contributes to the percept of naturalness of speech, and speech naturalness scores are affected most by frequencies between 7 kHz and 10.9 kHz (Moore et al., 2008). Elsewhere, Füllgrabe et al. (2010) found that listeners preferred both the pleasantness and clarity of speech low-pass filtered at 10 kHz to that filtered at 7.5 kHz. In turn, speech low-pass filtered at 7.5 kHz was preferred to that filtered at 5 kHz.

The high-frequency region was also found to provide cues to talker sex identification. Donai and Lass (2015) found that normal-hearing listeners were able to identify male and female speakers with 82% accuracy from naturally produced 250-ms vowel segments high-pass filtered at 3.5 kHz. In that study, the high-frequency band extended from 3.5 to 22 kHz, and the immediate low-frequency cues to voice (i.e., fundamental frequency) and vowel formants were eliminated. In another study (Donai and Halbritter, 2016), listeners were able to extract talker sex information from vowel segments high-pass filtered up to 8.5 kHz and from sentences high-pass

filtered up to 12 kHz. These results correspond to findings in Monson et al. (2014), who reported sex identification scores above 90% for sentences high-pass filtered at 5.7 kHz. Together, this research suggests the presence of perceptual cues to speaker sex in the high-frequency region of the speech spectrum.

There is also an emerging evidence that the high-frequency band provides useful linguistic information about vowels and consonants (Donai and Paschall, 2015; Vitela et al., 2015), and improves speech recognition in noise. Hayakawa and Itakura (1995) reported benefits of using information from a 10-kHz bandwidth in automated speaker recognition in noisy environments. Deshpande and Holambe (2011) reported improved speaker recognition in competing car noise from speech cues in 4- to 8-kHz frequency region. In another study, Macho and Cheng (2003) showed improved word recognition in noise when speech information in the high-frequency region above 4 kHz was included in their experiments.

The possibility that there is substantial relevant and accessible linguistic and paralinguistic information in high-frequency region has implications for the development of cochlear implants, hearing aids, cell phones and other communication technologies that are just now beginning to utilize this frequency range. Also, the high-frequency region may play an important role in real-world situations when the low-frequency portion of the spectrum is masked by environmental noises.

Against this background, the first aim of the current study is to determine whether perception of regional dialect can be influenced by spectral information in the high-frequency region, and how robust is this information when low-frequency cues are unavailable. Also, given the findings in Fox et al. (2016) that dialect cues are distributed differently for female and male speech across the low-frequency spectrum, the second aim is to determine whether different

high-pass filters also supply different sets of cues for dialect identification as a function of speaker sex. The third aim is to provide further supporting evidence that high-frequency region contains important cues to speaker sex identification. Finally, the fourth aim is to establish intelligibility of high-pass filtered speech as a function of filter frequency cut off.

Chapter 2

METHODOLOGY

2.1. Participants

Twenty two participants (6 male, 16 female) between the ages of 19 and 24 years (M = 21.18, SD = 1.10) served as listeners in this study. Nineteen of the participants were current or former undergraduate students at The Ohio State University. All participants were recruited by word of mouth. All participants resided in central Ohio, within an hour from Columbus, for at least 4 years continuously and either spoke or recognized the Midland dialect of American English that is spoken in Columbus. Five participants were born outside of central Ohio. One participant was born in Birmingham, Alabama and lived in Ohio for the majority of their childhood, but currently resides in Pennsylvania. One participant spent 6 years outside of Ohio. Only one participant underwent speech-language therapy as a child. Normal hearing and no disabilities was reported by all participants. The subjects were asked to participate in two separate listening tasks two weeks apart between January and June 2017.

2.2. Stimulus Material

The stimuli were short sentences and phrases spoken by 40 speakers: 20 from Ohio (OH) and 20 from North Carolina (NC) (10 male and 10 female). These were taken from a previous study conducted in the Speech Perception and Acoustic Laboratory on the effects of low-pass

filtering on gender and dialect perception. The stimuli consisted of recordings of informal talks collected in Central Ohio and Western North Carolina, representing the regional variant of the Midland and Southern dialects, respectively.

The speakers ranged in age from 51 to 65 years. Each speaker, contributed 10 different and unique phrases/sentences (N=400). The phrases were then compiled to form 10 different sets of 40 sentences, with each set containing one sentence/phrase from each of the speakers. Each set contained similar number of syllables for each dialect, which ranged from 8.4 to 8.9 syllables/sentence (OH mean = 8.45 syll/sent, NC mean = 8.86 syll/sent). Mean duration for OH sentences was 1791.66 ms and for NC sentences was 2063.22 ms. These duration differences reflect dialect-specific differences in articulation rate, which is greater for OH than for NC (Jacewicz et al., 2009). Within each of the 10 sets, the phrases were randomized separately.

Five experimental conditions were created with sentences high-pass filtered at 700, 1175, 1973, 3312, and 5560 Hz. The original unprocessed utterances were not used in this study. Butterworth high-pass filters with these frequencies at the stopband were used with passband frequencies 50 Hz higher in each case, which provided very sharp attenuation slopes. The upper limit of high-frequency region was at 11.025 kHz because the original recordings at 44.100 kHz were downsampled prior to high-pass processing. The experimental conditions are summarized in Table 2.1.

Table 2.1. Experimental stimulus conditions.

Condition	Stopband Frequency	Passband Frequency
700 Hz Highpass	700 Hz	750 Hz
1175 Hz Highpass	1175 Hz	1225 Hz
1973 Hz Highpass	1973 Hz	2023 Hz
3312 Hz Highpass	3312 Hz	3362 Hz
5560 Hz Highpass	5560 Hz	5610 Hz

Figures 2.1-2.5 Display spectrograms for the utterance “I work for the school system” high-pass filtered at 700, 1175, 1973, 3312, and 5560 Hz, respectively

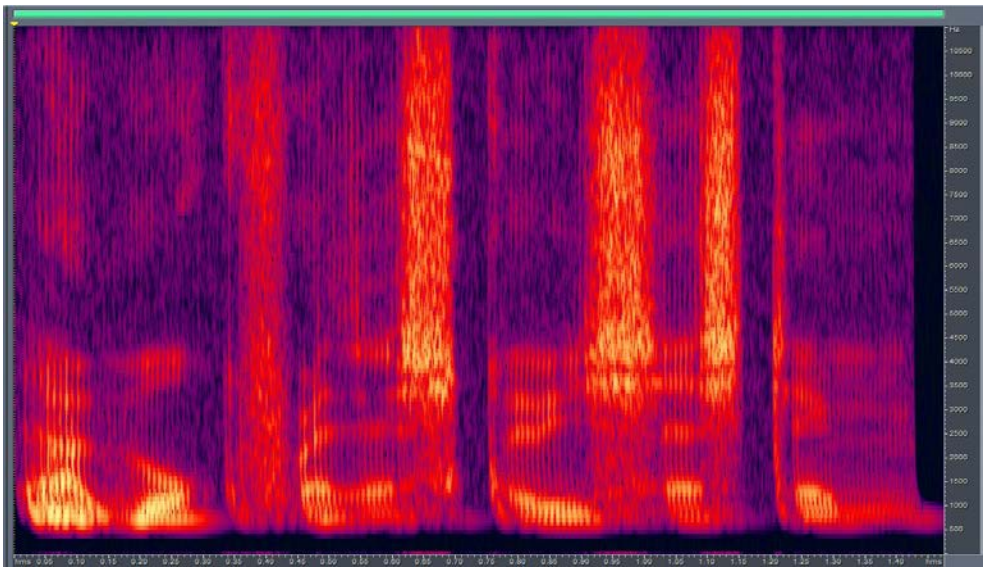

Figure 2.1. “I work for the school system” high-pass filtered at 700 Hz.

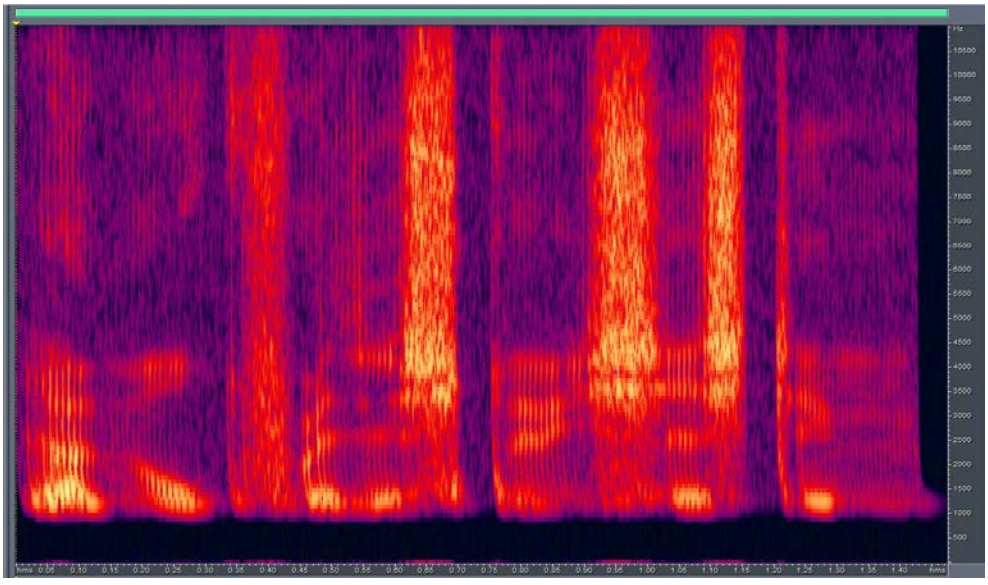

Figure 2.2 “I work for the school system” high-pass filtered at 1175 Hz.

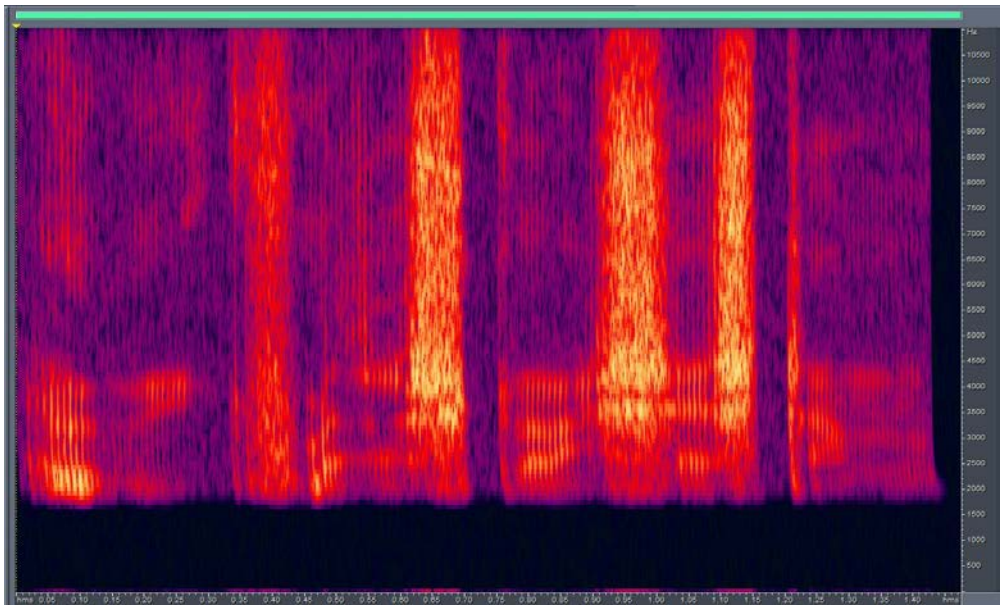

Figure 2.3. “I work for the school system” high-pass filtered at 1973 Hz.

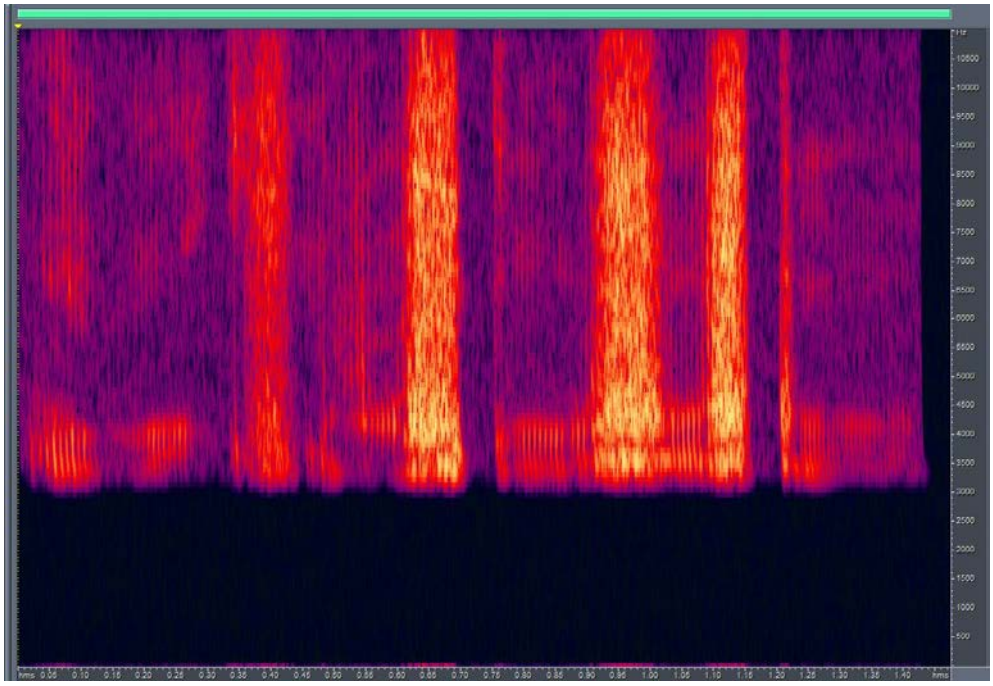

Figure 2.4. “I work for the school system” high-pass filtered at 3312 Hz.

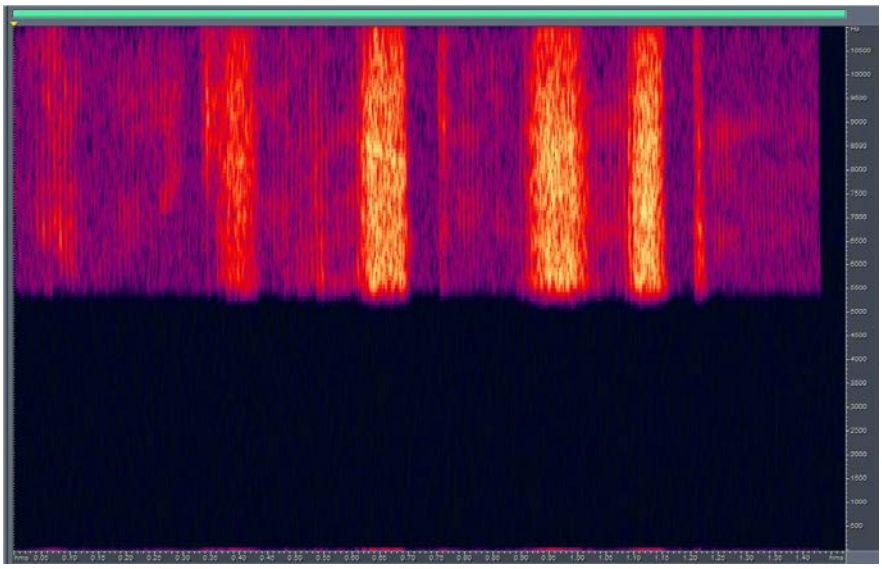

Figure 2.5. "I work for the school system" high-pass filtered at 5560 Hz.

For each individual listener, two of the 10 stimulus sets were randomly assigned to each of these five conditions so that each listener heard 80 unique sentences/phrases (40 OH, 40 NC) in each of the five conditions. The presentation order of these sentences was also pseudorandomly ordered such that listeners heard sentences in each of the five conditions before these conditions were repeated. Again, these randomizations were done for each separate listener such that no listener received the same sentence sets in the same conditions in the same order.

2.3. Procedure

This study consisted of two listening tasks: Identification and Intelligibility. Deciding which task was done first was counterbalanced. Nine participants started with the Identification Task and thirteen participants started with the intelligibility task. At the first session each participant was asked to fill out a background questionnaire that contained questions about

his/her speech, language, dialectal, and educational background. Participants were asked to come back at least 2 weeks later to complete the second task. The Intelligibility Task was completed in about 1- 1 ½ hours and participants were compensated $15 for their time. The identification Task was completed in 30-45 minutes and participants were compensated $10 for their time. This experiment was conducted under a protocol approved by the Institutional Review Board at Ohio State.

In the identification task, participants were asked to identify the sex and dialect of the speakers. Sennheiser 640 headphones were used in a sound attenuating booth where each listener heard one utterance at a time. After hearing an utterance, the participants indicated if they thought they speaker was male or female, from Central Ohio or North Carolina. To select their choose, they used a computer to click (using a mouse) on one of the four response boxes displayed on the computer monitor in front of them as shown in Figure 2.6.

Figure 2.6. A screen shot of response boxes used by the participant during the identification task to indicate geographic region and sex of the speaker.

In a separate intelligibility task, participants heard utterances over Sennheiser 640 headphones in a sound attenuating booth and asked to write down what they heard. The five experimental conditions from the same 40 speakers were used. Each listener heard each utterance over Sennheiser 640 headphones in a sound attenuating booth. After hearing an utterance, a text box appeared (see Figure 2.7) where participants typed what they heard, and then clicked "OK" once they were satisfied with the response.

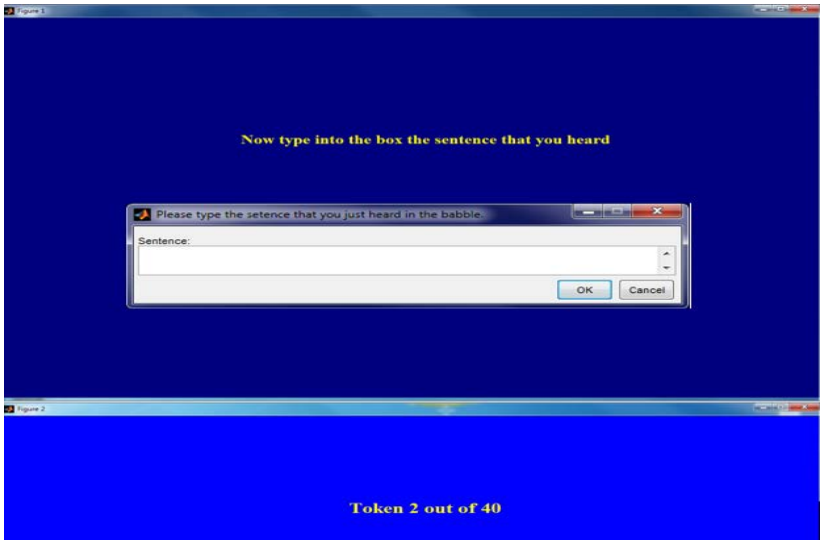

Figure 2.7. A screen shot of the text box used by the participant in the intelligibility task to report what words they heard.

For both tasks (i.e., identification and intelligibility), the experimenter verbally explained to the participants seated in the sound attenuating booth that they would be hearing many phrases spoken by male and female speakers from the Midland and Southern dialectal regions. They were asked to follow the instructions on the screen, depending on the task being presented, and listen carefully. If a participant was unsure how to answer, he/she was instructed to make their best guess. The experimenter then left the booth. Before the task began, participants were

provided with a practice set of 20 sentences with selected high-pass filter levels to ensure they understood the instructions. Between each set, the participants were able to take a break, ask questions or express concerns.

Chapter 3.

RESULTS

3.1. Identification task

Listener responses for the identification task were analyzed using Signal Detection Theory (SDT) (Green & Swets, 1966; Macmillan & Creelman, 2005), followed by analysis of variance (ANOVA) and t-tests. Unlike percent correct accuracy scores, SDT is a preferred statistical approach in analyzing listener responses under different degrees of stimulus uncertainty because it allows for the separation of sensitivity and bias (Lynn & Barrett, 2014). In this analysis, the correct categorization of an OH talker was a hit and the categorization of a NC talker as an OH talker was a false alarm. Nonparametric measures of sensitivity (*A'*) (Snodgrass & Corwin, 1988) was used because the data were not normally distributed.

3.1.1. Dialect identification

Using IBM SPSS Statistics v. 24 (2016), a two-way repeated-measures ANOVA with the within-subject factors talker sex and high-pass filter level (henceforth filter) was used to analyze dialect sensitivity data (*A'*). *A'* is a measure whose values range from 0.0 to 1.0. There was a significant main effect of filter [$F(4, 84) = 102.52$, $p < .001$, $\eta_p^2 = .830$]. All pairwise comparisons were significant, indicating that listeners were increasingly less sensitive to talker dialect with

each higher frequency cut-off. Dialect sensitivity as a function of filter is illustrated in Figure 3.1.

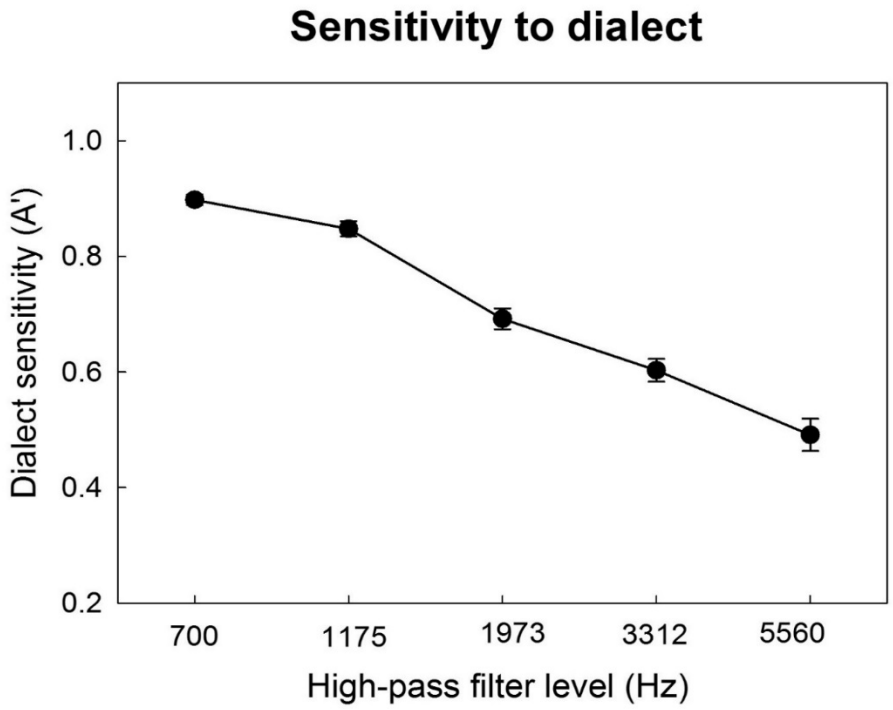

Figure 3.1. Dialect sensitivity as a function of filter.

The main effect of talker sex was not significant, indicating that listeners' decisions about dialect were not influenced by whether their heard a male or a female speech. However, a significant filter by talker sex interaction showed that talker sex did contribute to listeners' identification choices at selected frequency cut-offs [(F(1.8, 37.6) = 4.66, p = .019, η_p^2 = .181, GG]. This interaction is shown in Figure 3.2. A subsequent paired-samples t-test comparing male vs. female differences at each filter indicated that listeners were significantly more sensitive to talker dialect in female speech than in male speech for two filters, at 1175 Hz [t(21) = -2.97, p = .007], and at 1973 Hz [t(21) = -4.78, p < .001].

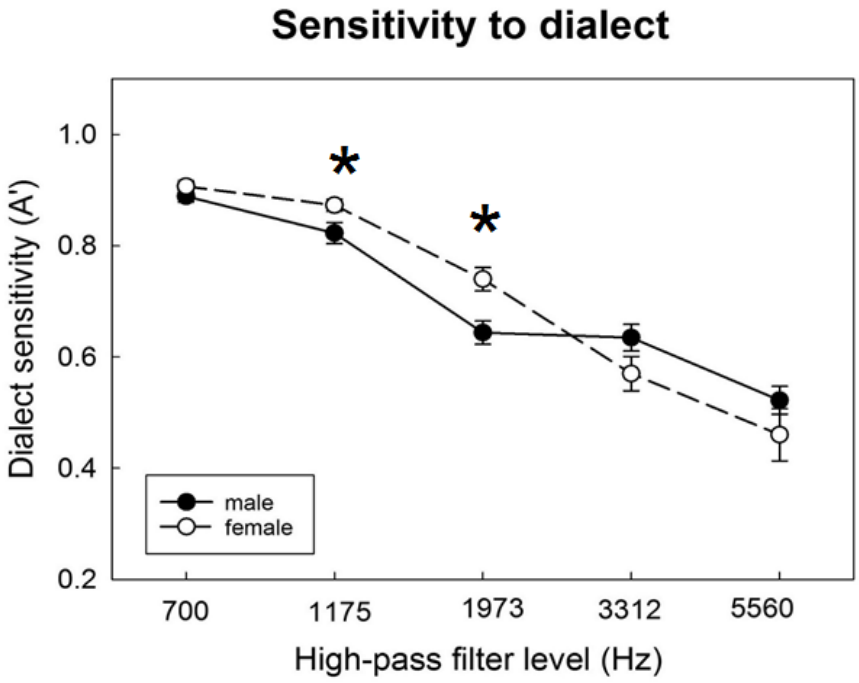

Figure 3.2. Significant interaction between talker sex and filter.

3.1.2. Identification of talker sex

Sensitivity (*A*′) to talker sex was analyzed using a repeated-measures ANOVA with the within-subject factors filter and dialect. Overall, sensitivity to talker sex was high (*M* = 93 RAU). However, the significant main effect of filter [$F(4, 84) = 50.57$, $p < .001$, $\eta_p^2 = .707$] indicated that listeners were less sensitive to sex cues at higher frequency cut-offs. In particular, post-hoc tests showed that only the pairwise comparisons between 700 and 1175 Hz and between 1175 and 1973 Hz were not significant at the Bonferroni-adjusted level $\alpha = .005$. All other comparisons were significant, showing that sensitivity to talker sex declined primarily at the two highest frequency cut-offs at 3312 and 5560 Hz

The main effect of dialect was not significant. However, there was a significant filter by dialect interaction [($F(4, 84) = 9.94$, $p = .001$, $\eta_p^2 = .321$]. This interaction is shown in Figure 3.3. The significant interaction arose because talker dialect differentially influenced listeners' decisions at the two highest filters. Listeners were significantly more sensitive to talker sex in response to OH dialect at 3312 Hz and in response to NC dialect at 5560 Hz.

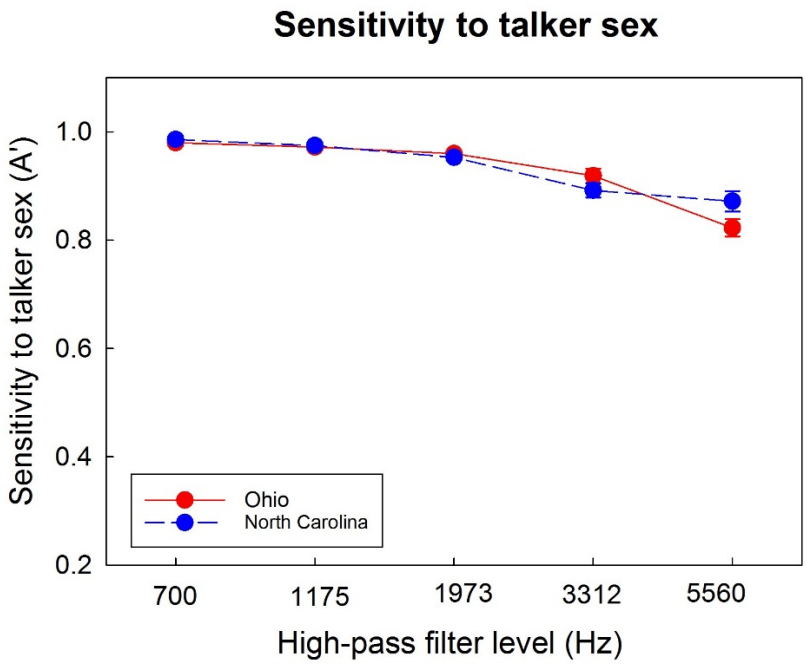

Figure 3.3. Sensitivity to talker sex as a function of dialect and filter.

3.2. Intelligibility task

The written responses of listeners in the intelligibility task were digitally recorded and scored on the basis of keywords. A scoring system for this task for adopted from Fox et al.

(2016). Accordingly, words with added or deleted morphemes were counted as incorrect and those containing spelling errors were counted as correct. There were 2-3 keywords for each utterance (see the Appendix). Raw scores for each participant were first converted to percent correct and then to rationalized arcsine units (RAU) (Studebaker, 1985) to ensure valid assessment of differences across the entire range of the scale after normalizing for ceiling and floor effects. This conversion extended the 0-100% scale so that the new RAU values ranged from -23 to 123 RAU.

A three-way repeated-measures ANOVA with the within-subjects factors dialect, talker sex and filter was used to analyze the RAU values. All main effects and all interactions were significant. The significant main effect of dialect [$F(1, 21) = 99.78$, $p < .001$, $\eta_p^2 = .826$] showed that, on average, listeners were able to better understand OH talkers ($M = 43.23$ RAU) than NC talkers ($M = 36.39$ RAU). The main effect of talker sex [$F(1, 21) = 161.05$, $p < .001$, $\eta_p^2 = .885$] indicated that female talkers were significantly more intelligible ($M = 44.83$ RAU) than male talkers ($M = 34.79$ RAU). The main effect filter [$F(4, 84) = 1221.42$, $p < .001$, $\eta_p^2 = .983$] showed that intelligibility progressively decreased with each higher frequency cut-off as shown in Figure 3.4. As can be seen, there was a dramatic drop in intelligibility from 80 to 27 RAU at 1973 Hz frequency cut-off, and speech became almost unintelligible thereafter.

A significant interaction between dialect and filter [$F(2.8, 57.9) = 6.62$, $p = .001$, $\eta_p^2 = .983$ (GG-adjusted)] is shown in Figure 3.5. This interaction shows that listeners were able to understand utterances in their own dialect (OH) better when speech was less degraded (700 Hz, 1175 Hz, 1973 Hz). In the most degraded conditions (3312 and 5560 Hz), there was no dialect advantage because utterances became almost unintelligible.

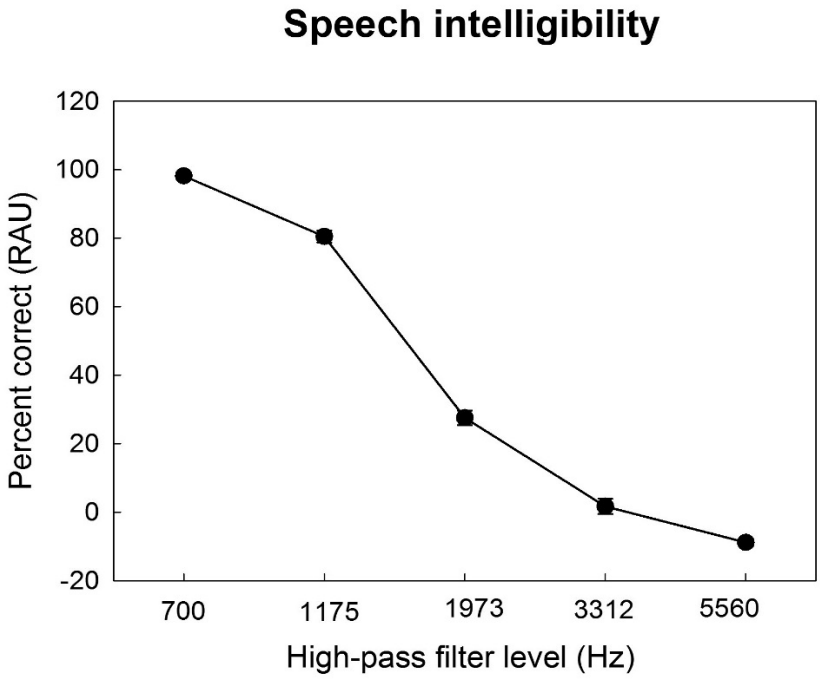

Figure 3.4. Intelligibility of utterances as a function of filter.

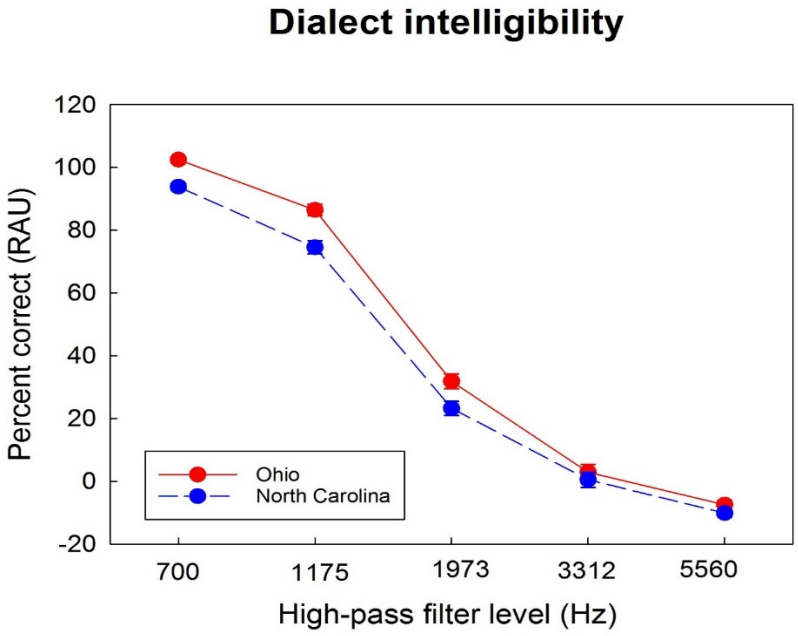

Figure 3.5. Significant interaction between dialect and filter.

A significant interaction between dialect and talker sex [$F(1, 21) = 14.41$, $p = .001$, $\eta_p^2 = .407$] is illustrated in Figure 3.6. This interaction shows that, although on average, female talkers were more intelligible than male talkers, the female talker advantage was greater for NC dialect and the sex-related difference became smaller when listeners heard utterances in their own OH dialect.

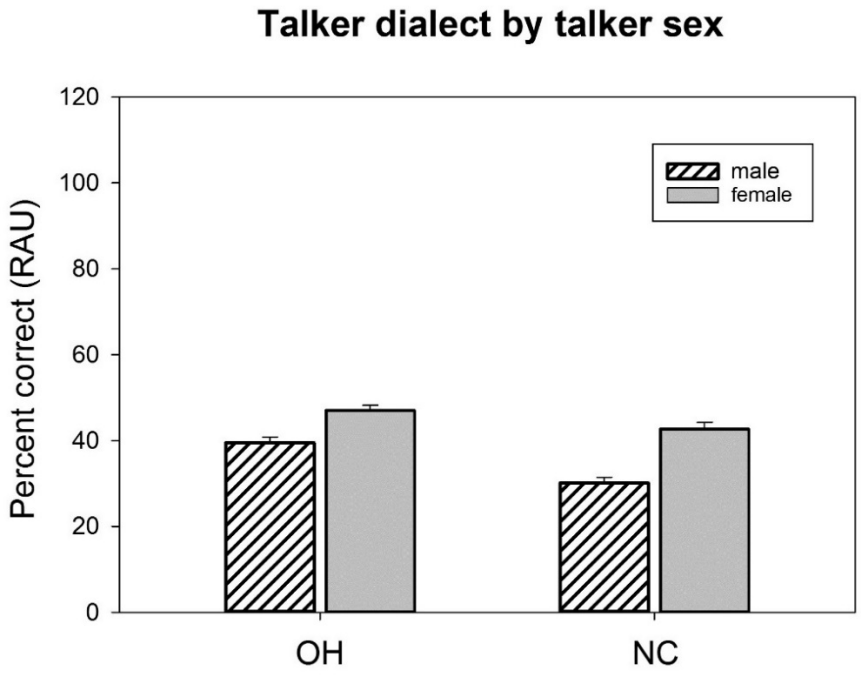

Figure 3.6. Significant interaction between dialect and talker sex.

The third significant two-way interaction was between talker sex and filter [$F(4, 84) = 22.34$, $p < .001$, $\eta_p^2 = .515$]. This interaction arose because listeners were able to understand utterances spoken by female talkers better except for the easiest (700 Hz) and the most difficult (5560 Hz) conditions, that is, when utterances were either easy or very difficult to understand. This interaction is shown in Figure 3.7.

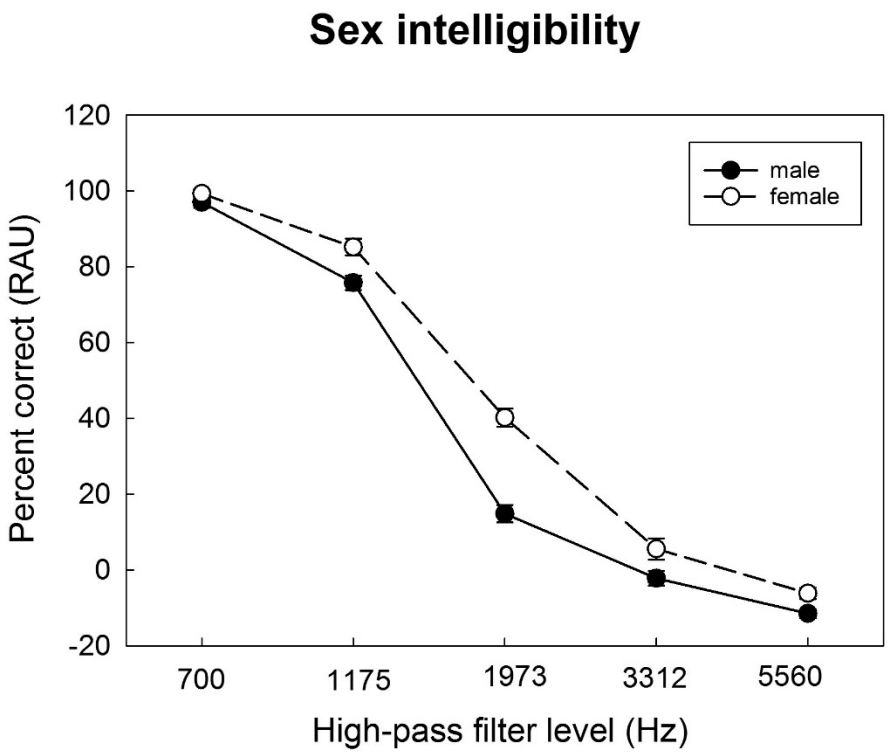

Figure 3.7. Significant interaction between talker sex and filter.

Although significant, the three-way interaction between dialect, talker sex, and filter had a smaller effect size than either of the two-way interactions [$F(4, 84) = 3.99$, $p = .005$, $\eta_p^2 = .160$]. This interaction did not produce additional insights and is not discussed at present.

Chapter 4.

SUMMARY AND DISCUSSION

The current study explored the contribution of spectral information in the high-frequency region to identification of talker dialect and talker sex, and determined intelligibility of high-pass filtered speech. The findings are discussed separately for each experimental task, that is, identification and intelligibility.

4.1. Identification results

The major finding was that listeners were increasingly less sensitive to talker dialect with each higher frequency cut-off. This result is not surprising because each higher frequency cut-off decreased the amount of spectral features related to vowels and consonants, and dialectal differences are reflected mostly in the pronunciation of these segments. Important differences related to talker sex were found for two filter cut-offs, at 1175 Hz and at 1973 Hz, in that female speech provided a greater amount of dialect cues than male speech. This result is also not surprising because more acoustic cues to speech segments can be found in female speech up to 3000 Hz due to physiological differences in vocal tract length. For example, formant frequency values in vowels are higher in females and comparatively more information about vowels will be preserved at 1175 Hz and 1973 Hz frequency cut-offs. Consequently, listeners benefitted more from female speech when hearing utterances filtered at these two filter cut-offs, and no further improvement as a function of talker sex was found at frequencies above 3000 Hz.

Sensitivity to talker sex was of particular interest in this study in light of the previous literature reporting the presence of perceptual cues to speaker sex in the high-frequency region of the speech spectrum. For example, Monson et al. (2014) found that sentences high-pass filtered at 5.7 kHz were identified with above 90% accuracy. One of the aims of the current study was thus to provide further support for the emerging position in research that information about talker sex is distributed over much wider frequency range and not only in the lowest frequency band corresponding to fundamental frequency. The robust finding of the current study was that sensitivity to talker sex was high, and a modest (although significant) decrease was found only at the two highest frequency cut-offs.

In Figure 4.1, sensitivity to sex is plotted against sensitivity to dialect. As can be seen, listeners were able to hear the difference between male and female speech very well even when little spectral information was available at the highest frequency cut-off. The exact RAU value at the highest cut-off at 5.56 kHz was 85 RAU, which approximates the 90%-accuracy level at 5.7 kHz reported in Monson et al. (2014). However, it is noteworthy that dialect identification was relatively high across all high-pass filter conditions, and still above the chance level when speech filtered at 3312 Hz. Even at the highest frequency cut-off, listeners were still able to detect some of the dialect-related differences.

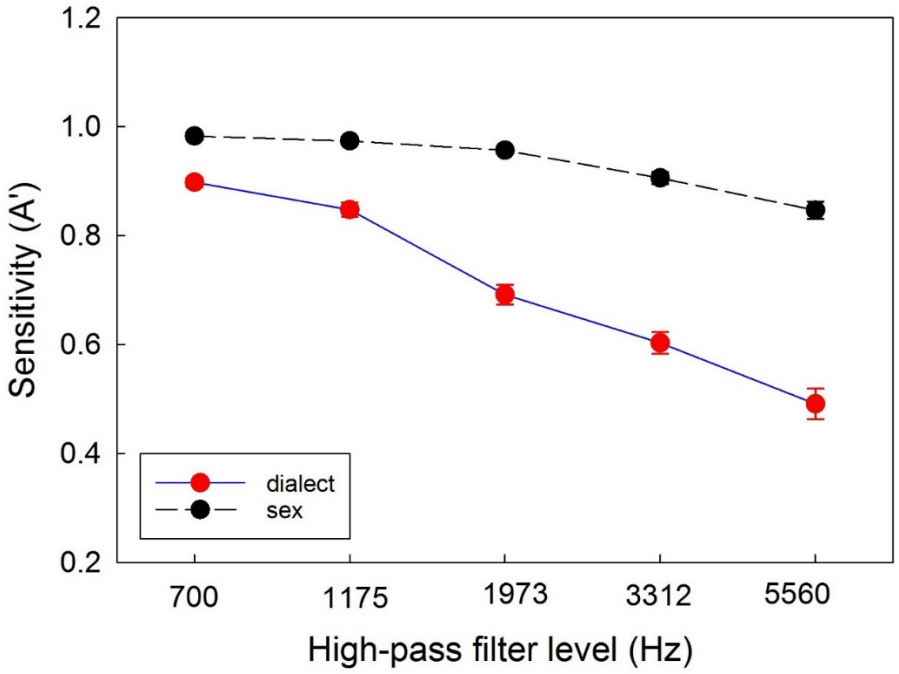

Figure 4.1. Sensitivity to talker sex and dialect in the Identification Task.

Together, the identification results indicate that high-frequency energy in speech does contribute information about talker characteristics and that listeners can utilize these cues in identifying sex and regional dialect of the talker.

4.2. Intelligibility results

The intelligibility results show that each higher filter provided less semantic content. Intelligibility was high when utterances were filtered at 700 Hz, reaching 100 RAU, and declined dramatically at 1973 Hz. Speech high-pass filtered above 3000 Hz became unintelligible. Scores in response to female talkers were higher relative to male talkers for the two filter levels at 1175 and 1973 Hz, indicating that female speech provided more intelligibility cues in the frequency band between 1000 and 2000 Hz. There is a correspondence between the higher intelligibility and the greater dialect sensitivity for females found in the identification task, indicating that the sex-related differences in this spectral region reflect differences in vocal tract physiology between females and males. Also, listeners understood utterances better when talkers were from Ohio rather than from North Carolina, indicating that experience with their native dialect increased their speech comprehension.

It is also important to note that the high-frequency region still provided a great amount of information about talker dialect despite the decreased intelligibility of speech. Although linguistic (message-oriented) information was basically absent in speech high-pass filtered little above 3000 Hz, indexical information about talker dialect and sex was still present, indicating that the high-frequency region may play an important "supporting" role in real-world listening environments. To illustrate this point, Figure 4.2, shows accuracy data for intelligibility and dialect identification as a function of high-pass filter level. The intelligibility data were replotted from Figure 3.4 and the dialect identification accuracy (in Task 1) was expressed in RAU.

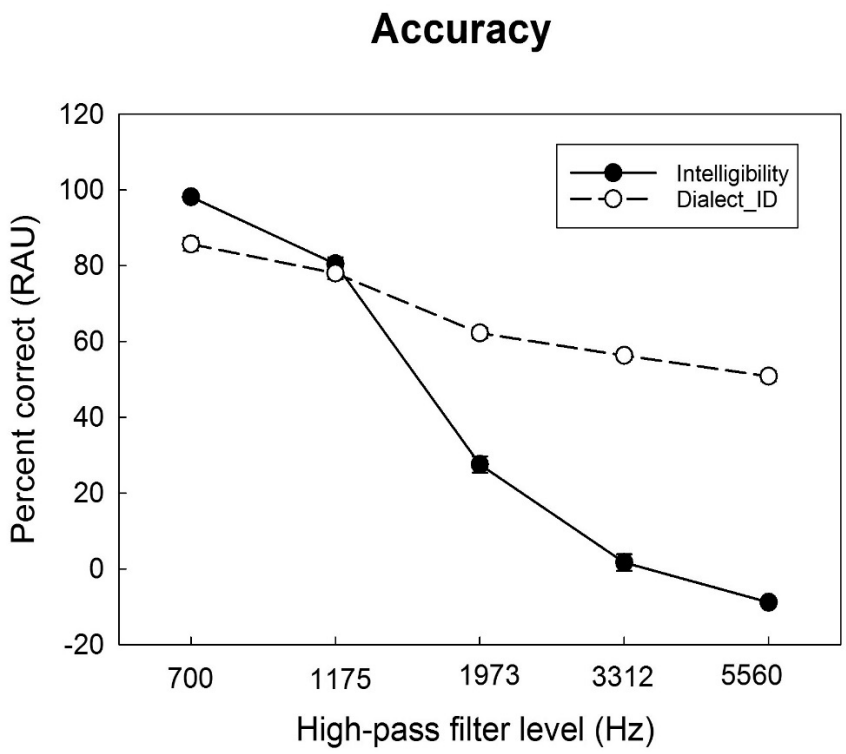

Figure 4.2. Intelligibility and dialect identification accuracy.

As can be seen in Figure 4.2, there is a discrepancy between listeners' comprehension of speech high-pass filtered above 3000 Hz and their ability to identify dialect of the talkers. These results imply that perceptual cues to understanding a linguistic message are contained exclusively in the low-frequency region and information about talker characteristics is distributed over a wider speech spectrum.

In conclusion, high-frequency regions may reinforce the presence of perceptual cues to indexical features in speech, including talker dialect and sex. The current study support previous reports that cues to talker sex identification can still be found in the high-frequency band. It also contributes new findings about the presence of dialect cues and how these cues are distributed for male and female speech.

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State of Speaker	Sex of Speaker	Number of Syllables	Duration (ms)	Order	Sentence
OH	female	5	1203	1	I have **two children.**
NC	female	12	2660	2	And I found many of their **death certificates**.
NC	male	13	4767	3	My **paternal** grandfather was a **Baptist preacher**.
OH	female	10	1821	4	And I should tell you about my **new kitten**.
NC	male	12	2153	5	So that was an **interesting experience**.
NC	female	10	1881	6	And I could **remember** her very well.
NC	male	6	1392	7	They like to **hear** me **talk**.
NC	male	6	1576	8	He **calls** me **everyday**.
NC	male	6	1426	9	That's **all** I've got to **say**.
NC	female	14	3254	10	My **granddaughter** was born 2 **months** after my **mother** died
OH	female	13	2358	11	I enjoy doing it and they **enjoy getting** them.
NC	female	6	1839	12	I **guess** her **heart** was **big.**
OH	male	12	2306	13	I've been **practicing law** since 1982.
NC	male	5	2071	14	We had a **string band**.
NC	female	7	2129	15	And I have three **grandchildren**.
OH	female	5	1288	16	It's my **married name**.
OH	female	11	2148	17	We **moved** back here in **1987**.
NC	female	9	2823	18	My **mother** is eighty three years **old**.
OH	male	12	2070	19	I **finished** my **master's** here in seventy one.
OH	female	5	1347	20	I learned to **tap dance**.
OH	female	12	1903	21	He had to **go** to the veteran's **hospital**.
OH	male	9	1548	22	That was the **best part** of the whole **thing**.
OH	male	13	2240	23	You could make a **radio** or a **burglar alarm**.
OH	female	5	1590	24	He is very **tall**.
NC	female	5	1503	25	He's a **fisherman**.
NC	male	12	2906	26	The **superintendent** sent me to **Providence**
OH	female	6	2009	27	There's the **barking beagle**.
OH	female	8	1370	28	It only lasted for three **years**.
NC	female	8	1502	29	I kept **scrubbing** the **shower** stall.
NC	female	14	2592	30	And it's the most **wonderful** thing- being a **grandparent**.
NC	male	6	1069	31	You have to **deal** with her.
OH	male	6	1083	32	They would **live** to the **south**
OH	male	5	1545	33	The seats were **great seats.**
NC	male	5	1210	34	**Let** me hear you **talk**.
OH	male	10	1796	35	There's currently a **job opening** there.
OH	male	10	2204	36	My **dad** was sort of a **hobby farmer**.
OH	male	5	1327	37	The **high school's** the same.
OH	male	7	1811	38	My **oldest** is **twenty three**.
NC	female	6	1569	39	I'm not **ashamed** of it.
NC	male	14	2095	40	They decided to open a **laundry** and **dry cleaners**.

state	sex	#syll	dur	order	Sentence
OH	male	14	2437	1	**Traffic** was obviously getting **worse** as we came **home**.
NC	female	9	1703	2	It was a **bustling community**.
NC	female	14	2488	3	She was **not dependent** on a lot of other **people**.
OH	female	7	1269	4	Yeah so they **come** over **here**.
NC	female	7	2169	5	So I **ran down** to the **shed**.
NC	male	10	2131	6	You've got to go **see** this **woman**.
NC	male	6	1032	7	That was a **bad** mistake.
OH	female	11	1938	8	The **love** you **receive** is **unconditional**.
NC	female	5	964	9	I **love** the **mountains**.
OH	female	11	2744	10	And it has **been** in my **family** every **since**.
NC	male	13	3887	11	He would **walk** to the **church** and then back home on **Sundays**.
NC	female	7	1646	12	They used to **play** full **court** then.
NC	female	12	3539	13	And I've made a **book** for each of our three **children**.
OH	female	9	2124	14	I went to their **college** of **nursing**.
NC	male	7	1346	15	There was a little **fellow**.
OH	female	5	879	16	But it was **worth** it.
OH	female	5	1380	17	**Mom**, you've **burned** me out.
NC	male	9	1824	18	**Kathy** came out by the **wall** one **day**.
OH	male	7	1282	19	We got **married** in **August**.
NC	male	6	1689	20	And he's **lived** here for **years**.
NC	male	7	1508	21	I hadn't **checked** up on her.
OH	female	8	1053	22	I became a **librarian**.
NC	female	11	2315	23	In their **married** years they were around **Cleveland**
OH	male	12	2709	24	Well it **seemed** like it was really **high** at the **time**.
OH	female	12	1718	25	He has an **international studies** degree.
OH	male	7	1420	26	She needed a **break** from that.
NC	female	7	1766	27	We've sort of **retired** here.
OH	male	14	3129	28	And I **arrived** in my **driveway** at 2:30 AM.
NC	female	12	2908	29	More **words** were coming but they were a **different** verse.
OH	female	6	1355	30	That's always a **good thing**.
NC	male	10	1401	31	That's how **politicians** get **elected**.
NC	male	9	1650	32	And I ended up staying **twelve years**.
OH	female	6	1627	33	I like to **sew** and **quilt**.
OH	male	8	1365	34	He would **grow** things in the **summer**.
OH	male	5	1311	35	So he **moved** back here.
NC	male	10	2476	36	She was **fifteen days** over a **hundred**.
NC	female	8	1987	37	She's pretty **special** in our **lives**.
OH	male	10	2242	38	It's a very **competitive program**.
OH	male	7	1510	39	A **survey** of **linguistics**.
OH	male	6	1065	40	That was a lot of **fun**.

state	sex	#syll	dur	order	Sentence
OH	male	8	1372	1	We've been **married** thirty-nine **years**.
NC	male	9	1997	2	It takes **something** to get me **started**.
NC	male	8	1999	3	She's been real **good** for **stuff** like that.
OH	male	8	1860	4	She had no **worries** about that.
NC	female	7	1371	5	It was a **beautiful day**.
OH	male	10	1855	6	He's trying to get into **nursing school**.
OH	female	10	2049	7	So I had two **teaching certificates**.
NC	female	8	3000	8	You had to **find** a white **ash tree**.
NC	female	7	1524	9	My **life** is pretty **simple**.
OH	male	8	1286	10	My **mother** was a **teacher** too.
OH	female	5	983	11	Try to **adopt** one.
NC	female	8	1510	12	Now I live on Riverwood **Hill**.
NC	male	8	1435	13	My **wife** had just **left** on a **trip**.
OH	female	8	1742	14	He has **dreams** of **saving** the world.
NC	male	8	1267	15	Somebody has to **write** those **games**.
NC	male	7	1837	16	I was **born** during the **war**.
NC	female	9	2600	17	Where in the **world** have I **heard** this **song**?
NC	female	11	3205	18	We actually didn't **eat** on the **table**
OH	female	8	1766	19	My **husband** is an **attorney**.
NC	female	8	1850	20	She **takes** it right after **him**.
OH	female	12	2326	21	I do like **bumblebees** 'cause they help my **garden**.
NC	male	8	2055	22	They all were very **successful**.
OH	female	8	1339	23	But she **lives** in **Albuquerque**.
OH	female	9	1742	24	My passion is **Disney trivia**.
OH	female	6	859	25	I could **teach anything**.
OH	male	10	2126	26	But I'm a **huge** college **basketball** fan.
OH	male	11	2096	27	I've been **married** for almost 25 **years**.
NC	male	8	3888	28	We had him **saying "Fried Chicken**".
NC	female	7	1855	29	For about **fiftyfive years**
OH	male	9	1822	30	It's an **interest** of mine, a **hobby**.
NC	male	10	3134	31	We would **sail** the **bucket** lids through the **air**.
NC	female	10	2258	32	I never **recognized** any **difference**.
NC	male	10	1850	33	I **finished** in **1979**.
OH	male	10	1151	34	Our **trip** back was kind of **uneventful**
OH	female	8	1917	35	My **family** still likes coming **back**.
NC	female	10	2416	36	She **graduated** from **high school** this year.
OH	male	7	1163	37	Yeah it was a **lot** of **fun**.
OH	female	6	1396	38	I'm making **wall hangings**.
OH	male	7	1425	39	I **work** for the **school** system.
NC	male	10	2072	40	It was in the **rose garden** over there.

state	sex	#syll	dur	order	Sentences
OH	male	9	1653	1	And he **wants** to be a **pharmacist**
NC	female	14	2703	2	If you looked **hard** enough you could find the good in **people**
NC	male	7	1969	3	So what else can I **tell** you?
OH	female	8	1838	4	She was kind of a **reverse snob**.
NC	female	9	1875	5	I **don't** think it's putting on **airs**.
NC	male	8	2111	6	My dad was one of **eight children**
NC	male	7	1547	7	**People** still do that **today**.
NC	female	7	1424	8	She can **play** the **piano**.
NC	female	5	1393	9	And I heard her **scream**.
NC	female	8	1455	10	What're you **doing** with **shoes** on?
OH	male	8	1877	11	We just **came** back from **Savannah**.
NC	male	9	1645	12	This has been an exciting **school year**.
NC	male	9	1452	13	We had to **go** to the **library**.
NC	male	9	2037	14	Last year **Kathy** had **back surgery**.
NC	male	9	1388	15	We just had a **lot** of **fun** with that.
NC	female	12	2326	16	I remember both my **grandmothers** very **well**.
OH	female	6	1699	17	Her **name** is **Junie Mae**.
NC	female	8	1244	18	I got in the **shower later.**
OH	female	7	1975	19	I **worked** at Westland High **School**.
OH	female	7	1867	20	So I almost **came** back **home**.
NC	male	8	1955	21	There's a **cemetery** up there.
NC	male	12	2063	22	I was standing in the **cafeteria line**.
OH	female	6	1577	23	Tom **Tyrone starred** in it.
NC	male	9	1833	24	I don't **know** if you need to go **back**.
OH	male	8	1828	25	I now **coach baseball** in college
OH	female	12	3314	26	Make sure they don't **eat** any **foreign objects**.
OH	male	8	2153	27	My **dad** worked with **electronics**.
OH	female	10	1729	28	I could **see** changes in the **area**.
OH	male	9	1496	29	She's a very **talented** young **girl**.
NC	female	9	1935	30	I was the **middle** of three **children**.
OH	male	11	2570	31	We had a **great time** going up in **Jim's** van.
OH	female	9	2590	32	I have great **joy** in **witnessing** that.
NC	female	7	1859	33	But I don't like **boiled okra**.
OH	female	7	1156	34	I had a **double major**.
NC	female	12	1736	35	And he was the **superintendent** of schools there.
OH	male	10	1296	36	**Try** to get on the other **side** of it.
OH	male	10	1732	37	I just sort of **listen** to **speech patterns**
OH	male	8	1604	38	Well we **met** right before **Easter**.
OH	male	8	2001	39	So I had a lot of **earaches**.
OH	female	8	1293	40	I have a little **dog**, **Scooter**

state	sex	#syll	dur	order	Sentence
NC	female	6	1365	1	I think that's **wonderful**.
OH	female	13	2237	2	Now I try **not** to use any middle **initial**.
OH	female	6	1336	3	I had **hoped** he would be.
OH	male	5	781	4	It was a **good time**.
NC	male	6	1666	5	My **son** is **twenty five**.
NC	male	14	2037	6	There was about approximately **twenty three acres** here.
OH	female	6	903	7	Her **body** was **worn** out.
OH	female	11	2594	8	And it was always a very **friendly place**.
NC	female	12	2008	9	We're now thoroughly **enjoying** our **grandchildren**.
NC	female	5	1595	10	I **love** the **greenery**.
OH	female	10	2278	11	We **hope** to get another **dog** someday.
NC	female	10	2071	12	And I started **drying** off with a **towel**.
NC	female	10	2286	13	He was a very **interesting person**.
NC	male	6	1570	14	He's my **brother Joe's age**.
OH	male	5	874	15	We're **glad** to be **home**.
NC	male	6	1519	16	Y'all sure do **sound funny**.
NC	female	11	2073	17	And my **husband** only works one day a **week**.
OH	male	7	2147	18	So it was a little **strange**.
OH	female	7	1587	19	Our **life** has **changed** quite a **bit**.
OH	male	10	3375	20	It was **linguistics** 201 I think.
NC	female	7	2321	21	**Mom**, I'm **standing** on a **snake**
NC	male	7	1166	22	I **heard** I had a **good time**.
OH	male	13	2146	23	And I don't want to miss his **senior** year of **high school**.
NC	female	12	2477	24	They all had the **different accent** from what we did.
NC	male	12	2175	25	My **grandmother** never drove an **automobile**.
OH	female	5	1719	26	Now I **don't** like **bees**.
NC	male	7	1173	27	I **think** that's kind of **unique**.
OH	female	11	2895	28	The **older** I got the more **involved** I got.
NC	male	8	1399	29	**Everybody** didn't **do** that.
NC	male	10	2189	30	They don't have to go **through** these **corrections**
NC	male	10	2101	31	I know she's **worked** with several of those **kids**.
OH	female	5	892	32	That's **all** they could **teach**.
OH	male	5	855	33	We have **two daughters**.
NC	female	11	1959	34	That was the most **horrible experience**.
NC	female	8	2597	35	She could **look** after herself without any **trouble**.
OH	female	7	1390	36	But you do **have** to have **patience**.
OH	male	14	3367	37	I was able to **ride** up there with five very good **friends**
OH	male	11	1921	38	There's a lots of **shopping opportunities**.
OH	male	7	2283	39	He would **sell** things to **groceries**.
OH	male	12	2966	40	My **daughter** is majoring in **psychology**.

state	sex	#syll	dur	order	Sentence
OH	male	10	1706	1	We lived on **one corner** of the acreage.
NC	male	6	2213	2	They **grew** a large **garden**.
OH	male	12	2266	3	It was **called Christian** Outreach School of **Ministries**.
OH	female	8	1930	4	We've been **married** forty two **years**.
NC	female	12	2809	5	I have never **tried** to **change** my vernacular.
NC	male	5	1148	6	I met my **wife** there.
NC	female	7	1898	7	I **really** enjoy my **job**.
OH	female	6	1301	8	Well I have **thirty years**.
NC	male	7	1375	9	It's kind of **special** to me.
NC	male	13	1720	10	I've been an **equal opportunity employee**.
NC	female	13	2625	11	They're **pitiful** looking in their little **uniforms**.
NC	female	8	2084	12	I **like** to cut the **scraps** for her.
OH	female	6	1847	13	We **moved** into the **house**.
NC	female	12	2159	14	I finally **decided** to **close** the pewter **shop**.
NC	male	14	2784	15	We had to go around the **room** and **introduce ourselves**.
NC	male	11	2177	16	Some of the **places** are pretty **nice** places.
NC	male	6	1145	17	I'm not **sure** how she is.
NC	female	7	1466	18	He got **acquainted** with us.
NC	male	6	2577	19	**Daddy's people** came here.
OH	female	9	2296	20	We have been **married thirty** plus years.
OH	female	11	2542	21	I had to do **six years** to get both of them.
NC	female	8	1605	22	What are you trying to **tell me**?
NC	female	7	2926	23	My **mother** was born in **France**.
NC	male	13	4842	24	They don't have that **country** sound, that appalachian sound
OH	male	8	1322	25	It's far more than **pop** and **soda**.
OH	female	10	1766	26	My **father** had **died** at seventy five.
NC	female	11	3134	27	She's a very **strong-willed** and strong-headed **child**.
OH	male	7	1701	28	The **sun came** out which was **great**.
OH	female	8	1335	29	That's always a **priority**.
OH	male	9	1062	30	She's **applied** to do that for two **years**.
OH	male	10	1719	31	And it sounded like **interesting stuff**.
OH	female	6	1599	32	I'm **lucky** I've got **three**.
OH	female	6	1145	33	My **daughter** had **problems**.
OH	male	7	1860	34	He can **call** triple A **dad**.
OH	female	10	1840	35	**Poor** little **Mickey** was the **apprentice**.
OH	male	7	1502	36	And so he had to **choose** one.
OH	male	11	2019	37	On **Friday** I had a great **experience**.
OH	male	7	1540	38	She **works** for the **school system**.
NC	female	6	1515	39	Well I like **fried okra**.
NC	male	6	2116	40	I ride **horses** and **hunt**.

state	sex	#syll	dur	order	Sentence
NC	male	10	1777	1	She had to have me in a **hospital**.
OH	female	5	1579	2	**They're** a lot of **fun**.
NC	female	7	1567	3	I was **fifteen** when she **died**.
NC	female	9	2107	4	He had a **gold** Elgin **pocket watch**.
OH	female	8	2124	5	My **mother's house** was **sold** last year.
OH	female	7	1613	6	I also make **baby quilts**.
NC	female	8	1962	7	He **taught** and coached there for five **years**.
OH	male	10	1916	8	It's becoming a much **larger city**.
NC	male	7	1248	9	You just can't **go anymore**.
OH	male	8	1283	10	She has some **friends** that have **done** it.
OH	male	9	2135	11	My **son** doesn't have a **major** yet.
OH	female	10	2017	12	You **know** at three I was **tapping** along.
OH	female	8	2041	13	We have a **daughter** and two **sons**.
OH	female	8	1521	14	**We** don't go **back** very often.
OH	male	13	2830	15	We were able to find a **fairly** close **parking space**.
NC	female	8	1599	16	We do **horse** and **buggie weddings**.
OH	male	8	1522	17	My **dad** was a high school **teacher**.
NC	male	7	1286	18	Her **eyes** are getting **bigger**.
OH	male	10	1584	19	It was basically very **blue** collar.
NC	female	8	1664	20	We used to have a **lot** of **snakes**.
OH	female	6	1057	21	They just get **politics**.
NC	male	11	1609	22	Brady's gonna have **surgery** on his **shoulder**.
NC	female	11	3332	23	And that's one of my **proudest accomplishments**.
NC	male	7	1841	24	Well I'll **think** about it **Tom**.
OH	female	12	4033	25	It gave me something to **focus** on besides **grief**.
NC	male	8	1961	26	That's a whole lot **different today**.
NC	male	9	2506	27	Both the **kids** have been **involved** in **sports**.
NC	male	9	2475	28	My **parents** were **uneducated**.
NC	female	10	2064	29	But I didn't **like** the **sewing** part **much**.
OH	male	8	1489	30	He wants to be **independent**.
OH	female	6	1679	31	Sometimes I don't like **birds**.
OH	male	8	1536	32	So that's why there's such a **difference**.
OH	female	10	2519	33	My **daughter moved** into the other half.
NC	male	12	1666	34	I wanted to be a **radio announcer**.
OH	male	8	2743	35	They also had two **small children**.
NC	female	11	5026	36	We never got **boyond** three **generations**
NC	female	6	1292	37	My **husband** has a **boat**
NC	female	14	3025	38	The **words** are there in your head, if you would just **write** them down.
NC	male	7	2107	39	I grew up on **Pressey Creek**.
OH	male	7	1318	40	We'd **gone** to our **favorite spot**.

state	sex	#syll	dur	order	Sentence
OH	female	7	1805	1	My **daughter** now owns the **home**.
NC	female	8	1324	2	And they don't have any **children**.
OH	male	10	1705	3	I do a lot of **political work**.
NC	female	11	2892	4	And I went back on all the **old microfilm**.
NC	female	10	2183	5	My **mom** was the only one that **moved South**.
OH	female	9	1740	6	You're looking for the **tomato soup**.
OH	male	11	1747	7	The **temperature** wasn't gonna change at all.
NC	female	8	1623	8	But to him it was not **fiction**.
OH	male	7	1759	9	The **drive home** was very **long**.
NC	male	7	1121	10	I had a **boy** named **Tommy**.
OH	male	6	1554	11	Who has the best **sports team**?
NC	male	8	2124	12	I can't think of **anything else**.
OH	female	6	1570	13	We used to have **two dogs**.
OH	male	8	1113	14	They just don't want to **hire** me.
OH	female	8	1645	15	They need to be **spayde** or **neutered**.
NC	female	9	1624	16	Still couldn't put my **finger** on it.
OH	female	7	1515	17	My **bank account** was like that.
NC	male	6	1580	18	My **wife's** from **Michigan**.
NC	male	9	1901	19	We've been **divorced** for lots of **years** now
NC	male	8	1411	20	He was **eighty seven years** old.
NC	female	9	3227	21	**Homes, livestock, people** were washed away.
NC	male	10	2380	22	I was just **blown** away by **rock and roll.**
NC	male	11	2154	23	I have a **twenty** year old **daughter** named **Paige**.
NC	male	9	2582	24	It **showed** how much **energy** you had
OH	female	9	1480	25	She didn't **like** the **hypocrisy**.
NC	female	6	2272	26	Oh, good, mine's **tomatoes**.
NC	male	7	1582	27	He got **hurt** playing **football**.
OH	male	7	1488	28	That's a **lot** of **fun** as well.
OH	male	11	3083	29	My interest is **regional variations**
OH	female	12	2527	30	She **died** about six **years** ago at ninety six.
OH	male	10	2047	31	The **middle son** didn't like **sports** at all.
OH	male	8	1795	32	They will **contact** her by **email**.
NC	female	11	2383	33	Rachel I'm **sorry** but it's a **copperhead**.
OH	female	7	1172	34	I was **born** in **fifty four**.
OH	male	10	1389	35	We **lived** in a pretty good **neighborhood**.
NC	male	11	1983	36	The **wedding** proceeded according to **plan**.
OH	female	7	1214	37	Take **care** of them when **needed**.
NC	female	9	2351	38	There's a lot of things you **can't replace**.
NC	female	11	3441	39	I'm **married** to a **man** from this area.
OH	female	8	1696	40	There's been **people** here for ten **years**.

state	sex	#syll	dur	order	Sentence
OH	male	8	1889	1	I'm the **second** of four **children**.
NC	female	9	1926	2	Are you trying to **tell** me **something**?
NC	male	9	1955	3	I golf and **fish** when I have the **time**.
OH	male	7	1222	4	My **father** was a **lawyer**.
OH	male	10	1732	5	A lot of that is **migration patterns**.
NC	female	7	1805	6	We call her the **snake lady**.
OH	female	9	2760	7	Walt actually **wrote** under that **name**.
OH	female	7	1589	8	I call her **hotdog hound** dog.
NC	male	7	3291	9	Now, I don't wanna **be cruel**
NC	female	13	2098	10	The **mountains** are not the best **place** to make a living.
OH	male	12	1747	11	The **weather** was not gonna get any **better**.
NC	male	9	2279	12	Donna had the most **beautiful dress**
NC	male	10	1720	13	It was a **different time** to say the least.
NC	male	7	1481	14	I can't **think** of **anything**.
NC	female	8	1687	15	But that didn't **happen** for us.
OH	male	10	1652	16	Because everybody around us **stood**.
NC	female	7	2124	17	They **neither** one ever **drove**.
OH	male	7	1610	18	I **taught** for twenty-three **years**.
NC	female	12	3672	19	My **mother** taught my **daughter** and my granddaughter.
NC	male	9	1653	20	I've been a **musician** all my **life**.
NC	male	8	1938	21	My **phone** was that way for a **while**.
NC	male	9	2474	22	I enjoyed that **tenure** very **much**.
OH	male	8	1736	23	I took care of all the **sports fields**.
NC	female	8	1490	24	So she was very **free-hearted**
NC	female	14	2423	25	It's not really a **vegetable**, as I read, it's a **fruit**.
OH	male	10	2120	26	My **daughter** played **volleyball** and **softball**.
OH	female	7	1578	27	That's about all my **pet peeves**.
OH	female	6	1233	28	**Find** me the **skinny** one.
OH	male	7	1291	29	And we can **take care** of it.
OH	female	11	2302	30	I have a **master's** degree in **special** ed.
OH	male	10	2570	31	Well I had one **brother** and three **sisters**.
NC	female	7	1774	32	I had a **hard** time in **school**.
OH	female	8	1501	33	We **live** in one of the **suburbs**.
OH	female	7	2399	34	Now they have **nine grandchildren**
OH	female	9	2669	35	We lived in that **home** for fifty **years**.
NC	female	6	1802	36	But you **can't** buy **pictures**.
OH	female	8	1814	37	You know that's **somewhere down** the line.
OH	female	8	2060	38	And we've **lived** there **forty four** years.
NC	male	7	1973	39	We're in the **wrecker business**.
NC	male	10	1908	40	His **name** was Ed, I'll never **forget** him.

state	sex	#syll	dur	order	Sentence
OH	male	10	1732	1	So I **know** what really good **sweet corn** is.
NC	female	13	2581	2	While I was in the **shower** stall, more **words** would come in.
NC	female	10	1871	3	They didn't have any way to **make ice.**
NC	male	10	2632	4	I have no **ideal** what to **talk** about
OH	female	5	1276	5	I have **three children**.
NC	female	7	1310	6	We **stood** around the **table**.
OH	female	6	1503	7	He had **problems** with **peers**.
OH	male	11	2097	8	Then I also do all the **logo painting**.
NC	male	12	2254	9	They become **disoriented** very **quickly**.
OH	male	6	1878	10	**South** is down on Ann **Street**.
NC	male	8	1983	11	I **know** all those **Foxes** up there.
NC	male	7	1624	12	Oh yeah, he **got** it **down pat**.
OH	female	5	1483	13	You **start** from **square** one.
NC	female	8	3047	14	I can **cook** but I don't **like** to.
OH	male	12	2498	15	I know that **Route 40** is a linguistic line.
OH	female	5	1742	16	She **lives** in one **half**.
OH	male	5	1196	17	We had some **chickens**.
OH	female	11	2094	18	I **have** a new **granddaughter** who's five months old.
NC	female	8	1946	19	She is one **lucky** little **dog**.
NC	female	6	1411	20	I have her **school letter**.
NC	male	5	977	21	She was **born** down there.
OH	male	6	1514	22	**Traffic** was pretty **good**.
NC	male	10	2044	23	That's the **immediate plans** anyway.
NC	female	10	2330	24	I'll tell you **one** good **story** on myself.
OH	male	12	1973	25	The two **older** ones aren't doing **anything** now.
OH	female	5	1624	26	My **patience** was **less**.
NC	male	6	3447	27	We **played** with the **bucket** lids.
OH	female	14	3179	28	I have **credit cards** with "C" as my middle initial.
NC	female	9	2328	29	She never **talked** like my other **aunts**.
OH	male	11	1860	30	We're getting **close** to the **end** now I take it.
NC	male	8	1248	31	The **local people** didn't care.
NC	male	10	1187	32	Now I'm not **yelling** at **anybody**.
NC	female	11	5061	33	**Tomatoes** , green beans, **onions**, pepper, cabbage.
OH	female	12	2059	34	Now the two **older** ones can go into a **bar**.
OH	male	8	1686	35	The **sun** was **shining** where he was.
NC	female	10	2219	36	I have three **children**- two **boys** and one **girl**.
OH	female	6	1092	37	You're looking **up** and **down**.
OH	female	12	2260	38	Our **daughter** is finishing up **medical** school.
NC	male	10	1435	39	I **remember** being at a **concert**.
OH	male	8	1637	40	We'll **see** what happens on that **front**.